(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 334 609 B1**

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **15.06.94** (51) Int. Cl.5: **H01R 13/629**, H01R 13/635

(21) Application number: **89302800.1**

(22) Date of filing: **21.03.89**

(54) **Breakaway electrical connector.**

(30) Priority: **24.03.88 GB 8807006**
15.11.88 GB 8826629

(43) Date of publication of application:
27.09.89 Bulletin 89/39

(45) Publication of the grant of the patent:
15.06.94 Bulletin 94/24

(84) Designated Contracting States:
DE FR GB

(56) References cited:
GB-A- 2 085 242
US-A- 4 390 222
US-A- 4 533 796
US-A- 4 684 192

(73) Proprietor: **THE WHITAKER CORPORATION**
Suite 450,
4550 New Linden Hill Road
Wilmington, Delaware 19808(US)

(72) Inventor: **Meller, Andrew Graham**
12 Grayling Court
Grange Road
Ealing London W5(GB)
Inventor: **Baker, Robert William**
130 Brampton Grove
Kenton Middlesex HA3 8LF(GB)

(74) Representative: **Warren, Keith Stanley**
BARON & WARREN
18 South End
Kensington
London W8 5BU (GB)

EP 0 334 609 B1

Description

The present invention relates to an electrical breakaway connector having improved release characteristics.

Such an electrical connector is useful and almost mandatory in applications where emergency situations occur requiring immediate disconnection of the mating connectors with only a small tensile force place on the two cables which lead out of the connectors. It is also mandatory in these emergency situations that the two connectors do not become cocked or otherwise bound during disconnection which could hamper or prevent the disconnection between the two mated connectors.

One such application of breakaway connectors having emergency disconnection requirements is in the aircraft pilot's helmet, a breakaway connector is typically mounted to the base of the aircraft and a matable connector is connected to the pilot's helmet through data and power cable. The sophistication of the helmets has grown to require a multitude of signal and power contacts mounted within a small connection package, yet with the requirement that the mated connectors are easily disconnected. The breakaway aspect of the connector is critical in that during emergency ejection of the pilot, the connector must be released without undue binding of the two connectors.

A further requirement of the breakaway connector is that the connector upstands vertically in the disconnected position such that the connector is always upwardly facing vertical and therefore the pilot need only use one hand to connect or disconnect the half to his or her helmet. This of course is an ergonomic consideration rather than a safety consideration, yet an important consideration when viewing the cramped quarters which are found in military aircraft. With one connector mounted to the base of the aircraft, undue burden and inconvenience would be placed upon the pilot to require him or her to reach over with the second hand to make the connection between the aircraft connector and the helmet connector.

One breakaway connector is shown in U.S. Patent 4,684,192 which includes an aircraft connector which is connectable to the base of the aircraft and a helmet connector half which is provided with the pilot's helmet. The aircraft connector is connected to the aircraft base by means of a lanyard making the aircraft connector movable relative to the base of the aircraft, yet it does not allow the connector to upstand in a giv n position for the ease of connection and disconnection.

An electrical connector is shown in US Patent 4 533 796 which includes a ball and socket joint which is used as a rotatable connection for such cables as telephone cables which are typically umbilical in nature to expand and contract. The ball and socket joint is used to rotate the cable to ensure that the cord does not become entangled. The ball and socket joint is used in combination with spring loaded ball bearings in a race which allow the inner core to rotate thereby maintaining electrical continuity between inner and outer electrical terminals.

Given these requirements the present invention consists, according to one aspect thereof, in a breakaway electrical connector for quick disconnection from a mating electrical connector along a disconnection axis, the breakaway connector comprising a housing having secured therein electrical terminals for mating with electrical terminals of the mating connector and means for mounting the housing to a base so that the housing is movable with respect thereto; said mounting means including means to allow the breakaway connector to swivel, thereby aligning a longitudinal axis of the breakaway connector with said disconnection axis; characterized in that said swivel means includes means to resiliently bias the connector into a predetermined position.

In the preferred embodiment of the invention, the means allowing the connector to swivel comprises a ball and socket joint, the ball including a detent, while the socket is spring loaded to bias the connector into said predetermined position.

It is preferred that the mating face of the connector be upwardly facing relative to said base when the connector is in a disconnected condition.

The mounting means may comprise a resilient annulus extending about the disconnection axis for urging the housing against the base. Thus the ball and socket joint and the detents, are replaced by a single element, namely the resilient annulus, which forms the same functions thereas.

The resilient annulus may, in order to be self-damping, so that it oscillates as little as possible following a disconnection, be in the form of an elastomeric boot, or, if it is needed to operate under severe temperature cycling, in the form of a helical metal spring Preferably, however, the resilient annulus is in the form of a helical metal spring enrobed in elastomeric material, so as to have self-damping properties.

The housing may have a shoulder for engaging one side of the base and a stem, which may be in the form of a cable conduit, projecting from the shoulder and supporting the resilient annulus for engagement with the opposite side of the base, the stem passing through an opening in the base and supporting th resilient annulus, for exampl on a flange projecting from the base. Especially where the base is a pressure bulkhead, the elastomeric boot or the elastomeric material enrobing the helical spring, should be bonded both to the flang

and to said opposite side of the base, in sealing tight relationship. In any event, where the breakaway connector and the mating connector are provided with cooperating key and key way means to ensure that they are mated in the correct mutual angular relationship about the disconnection axis, the resilient annulus should be fixed both to the stem and to the base so that the breakaway connector cannot rotate about the disconnection axis.

According to another aspect thereof the present invention consists in an electrical connector as defined in claim 9.

Embodiments of the present invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is an isometric view of the connector of a first embodiment of the invention.

Figure 2 is an isometric view of the connector of Figure 1 showing the components exploded.

Figure 3 is an isometric view of the metallic shell of the connector.

Figure 4 is a cross-sectional view through lines 4-4 of Figure 3.

Figure 5 is an isometric view of the forward insert used in the connector.

Figure 6 is a cross-sectional view through lines 6-6 of Figure 5.

Figure 7 is an isometric view of the rear insert of the connector.

Figure 8 is a cross-sectional view through the center of the high voltage insert of the connector.

Figure 9 is an isometric view of the swivel backshell used in the connector of Figure 1.

Figure 10 is the swivel block which is used in the connector.

Figure 11A is an isometric view of the data terminals used in the subject connectors described herein.

Figure 11B is an isometric view of the coaxial terminals used in the connectors described herein.

Figure 11C is an isometric view of the high voltage terminals used in the present embodiment.

Figure 12 is an isometric view of the matable connector which is electrically connectable with the connector of Figure 1.

Figure 13 is a cross-sectional view taken through the center of the connector of the present embodiment and through the center of the connector shown in Figure 11, showing the two connectors partially mated.

Figure 13A is similar to the cross-sectional view shown in Figure 12 emphasizing th retention of the terminals within the high voltage inserts.

Figure 14 is the cross-sectional view of Figure 13 in the fully mated position.

Figure 15 shows the connector of Figure 2 in an upstanding position showing the swivel aspect of the connector in phantom.

Figure 15A is an isometric view of an alternative spring detent member.

Figure 16 is an isometric exploded view of part of a breakaway electrical connector of a second embodiment.

Figure 17 is an isometric view drawn to a larger scale than Figure 16, of an electrical connector for mating with the breakaway connector.

Figure 18 is a fragmentary longitudinal sectional view showing the connectors of Figures 16 and 17 in a partially mated condition, and illustrating electrical terminal assemblies thereof;

Figure 19 is a similar view to that of Figure 18 but being drawn to a larger scale than Figure 18 and showing the connectors in a fully mated condition.

Figure 20 is isometric view of the breakaway connector of the second embodiment when mounted to a base;

Figure 21 is an axial section view of the breakaway connector of the second embodiment when mounted to the base, but in which the electrical terminal assembly of the breakaway connector is not shown.

Figure 22 is a similar view to that of Figure 21 showing the breakaway connector in a tilted position in relation to the base.

Figure 23 is a similar view to that of Figure 21 but showing a modification of the breakaway connector.

With reference to either of Figures 1 or 2, the connector of the first embodiment generally includes a forward metallic shell 4 having inserted therein a forward insert 30 and a rear insert 60 having clipped between the two inserts 30, 60, a plurality of removeable terminals (Figures 11A-11C). The connector further includes a swivel backshell 120 and two swivel blocks, such as 140. The connector further includes a swivel backshell 120 and two swivel blocks, such as 140. With reference now to Figures 3 and 4, the forward metallic shell will be described in greater detail.

The forward metallic shell 4 includes a forward shroud, such as 6, with a second bore 10 which is of a smaller diameter than the forward shroud 6. The metallic shell 4 also includes a threaded end, such as 14, at the rearward end of the metallic shell. On the internal circumferential surface 10 is included a rib or a ring 12 which is integral with the shell and circumferentially surrounds the interior surface 10 and defines a forwardly and a rearwardly facing shoulder. Behind the rib 12 and in front of the threaded portion 14 is a snap ring groove, such as 22, the purpose of which will be described in detail subsequently. The connector includes a

latching structure which comprises integral blocks 16 on diametrically opposed sides of the metal shell 4 and includes a spring pin 20 and a roller 21 which ar disposed between the blocks which disposes a portion of the roller 21 in a window 18, projecting a portion of the roller 21 into the internal structure of the metal block, beyond or inside of the inner circumference of the metallic shell for latching to a matable connector.

With reference now to Figure 5, the forward insert 30 includes a forward barrel portion 32 for receipt of the plurality of terminals and includes three aperture sizes, 36, 44, and 50. At the rear of the insert 30 is a shoulder, such as 34. With reference to Figure 6, aperture 36 include a forward bore such as 42, an internal rib, such as 38, which defines a forwardly and rearwardly facing shoulder and a larger bore at the rear which is shown generally as 40. Aperture 44 similarly includes a rib, such as 46. Although aperture 44 includes a bore 48 on either side of the rib 46, having the same diameter. Aperture 50 includes a constant bore throughout.

With reference now to Figure 7, rear insert 60 is shown as including apertures 66 which are alignable with apertures 36 in the forward insert, with the bore size of the aperture 66 being smaller than the rear bore 40 of aperture 36. Apertures 70 are alignable with apertures 44 in the forward insert, with the diameter of the bores 70 being the same as the diameter of the bore 48. The apertures 78 are alignable with the apertures 50 in the forward insert 30, and an oblong recess, such as 74, surrounds the apertures 78 thereby defining a forward face 76. It should be noted from Figures 6 and 7 that the inserts 30 and 60 include complementary polarizing lugs 47 and polarizing apertures 79, which are different in size to ensure that the insert 60 is placed against the insert 30 with the recess 74 facing the rear face of the insert 30, and to ensure that the insert is properly rotated. Although only one polarizing lug 47 is shown in Figure 6, it should be understood that a second lug is located in a diametrically opposed position relative to the lug that is shown.

With reference now to Figure 8, the high voltage insert 90 is shown as including an aperture extending between the forward and rearward end generally defined by the numeral 92 which includes a first bore 94 which is continuous with a second bore 96 which defines a tapered lead-in 102 between the two bores 94 and 96. Aperture 92 further includes a forward bore 100 which defines a shoulder 98 between the two bores 96 and 100. The high voltage insert further includes two O-ring grooves 106 and 108 which are generally poised at the forward end of the insert 90. The high voltage insert 90 further includes a locking ring, such as 104, which is integrally molded with the insert and extends circumferentially around the insert.

Figure 9 shows the swivel backshell as generally including a threaded cap 122 having external threads which are complementary with the threaded end 14 of the metal shell 4, as shown in Figure 4. The swivel backshell further includes a swivel ball 124 having a V-groove 126 which surrounds the ball about its center. The swivel backshell further includes a rear cable clamp, such as 128, which defines a cable strain relief when a complementary clamp half 129 (Figure 2) is installed onto the clamp block 128. A cable receiving through hole 130 extends through the swivel backshell for the receipt of the data and power cable therethrough.

With reference to Figure 10, the swivel block 140 generally includes a flange 142 which is used for mounting the connector. The interior portion of the block 140 includes a complementary profiled surface 143 for surrounding the ball 124 of the swivel backshell 120. The swivel block 140 further includes a surface, such as 144, which circumferentially surrounds V-groove 126 of the swivel backshell 120. The swivel block further includes a plurality of threaded apertures, such as 146, which extend radially towards the center of the peripheral surface 144 to receive detent spring assemblies 150, having a threaded cap and a spring loaded ball, such as 152. It should be understood that when in use, two such swivel blocks 140 are used which are shell halves which interlockingly mate by means of alignment pins 147 and grooves 149.

An alternate detent spring assembly is shown in Figures 15 and 15A as 150′ which includes a ring 154′ having resilient fingers 156′ stamped out from the material which forms the ring. Four detent balls 152′ are included which cooperate with the fingers 156′.

With reference now to Figures 11A-11C, the terminals are shown which comprise the electrical connections, and include pins 160 and sockets 320 for the transmission of data signals, (Figure 11A); coaxial pins and sockets 190 and 330 for data transmission, (Figure 11B); and high voltage pins and sockets 310 and 220, (Figure 11C). Reference to Figure 11A shows that the pin 160 comprises a pin portion 164, a crimpable portion 166 and a band portion 162 which is of a greater diameter than the crimpable portion thereby forming a forwardly and a rearwardly facing shoulder. Retention clip 170 is also shown as including a cylindrical portion 172 including integral retention fingers 174 which extend inwardly towards the center of the clip. Figure 11A also shows a socket 320 which is identical to socket 220, which will be described herein; and a retention clip 328, identical to clip 170.

With reference now to Figure 11B, coaxial pin 190 is shown as including an outer conductive housing including a forward shroud portion 200, a central constricted portion 196, a bulged or contracted portion 198, and a rear end portion 202. A retention clip 206, having fingers 208, is snapped into and around the constricted portion 196. Reference to Figure 16 shows that the interior of the coaxial terminal 190 includes a pin section 192, having a crimpable portion 194, the pin portion 192 and the crimpable portion 194 being insulated from the exterior housing member. Similarly, the coaxial socket 330 includes an outer conductive housing which includes a forward conductive shell 332, a constricted portion 334, a bulged portion 336, and an end portion 338. Coaxial socket 330 further includes an identical retention clip as retention clip 206. As shown in Figure 16, the interior of the coaxial socket includes a tube 339 which is matable with a coaxial lead at the rear end and which is matable with the coaxial pin 192 at its opposite end.

Reference now to Figure 11C shows the high voltage assembly as including the insert 90, a socket 220, a retention clip 112 and a retention collar 110. Socket 220 is identical to socket 320 and includes a crimpable portion 222, a socket portion 224, and a central band portion 226. The interior of the collar (Figure 13A) includes a shoulder 113 which is smaller than the diameter of the retention clip 112. Pin 310 is identical to pin 160 which was described above.

In order to assemble the connector, the cable is first inserted through the opening 130 in the swivel block, and then the individual conductors are terminated to their respective terminals. For example, the data conductors 236 can be terminated to the crimpable portions 166 of the terminals 160 (Figure 11A); the coaxial conductors 234 are terminated to the crimpable portions 194 (Figure 13); and the high voltage terminals are prepared by placing the conductor of the cables 238 within the crimpable ends 222 and the conductors crimped in place.

To retain the terminals 160 within their respective apertures, the connector housing is preassembled by placing the forward insert 30 within the metallic shell 4, placing the retaining clips within the apertures 40, and then assembling the rear insert 60 in place within the metallic shell 4, and locked in place within the shell 4 via the snap ring 230. The retention clips 170 remain within the apertures 40 as th diameters of the apertures 66 in the rear insert 60 are smaller than the diameters of the retention clips 170. At the same time the retention clips 170 are sandwiched between the forward 30 and rear 60 inserts, the high voltage inserts 60 are sandwiched between the inserts 30 and 60 also. The terminals 160 are then insertable through the respective apertures 60 and 40, and snapped into the position shown in Figure 13.

The high voltage terminals 220 are retained within the high voltage inserts 90 via the retention clips 112 and the collars, and the retention clips 112 and the collars can either be preassembled within the high voltage inserts 90 prior to the assembly of the inserts 90 between the inserts 30, 60, or can advantageously be assembled after their assembly. In either event, the retention clip 112 and the retention collar 110 are slid forwardly into the high voltage inserts 90 until the front ends of the collars 110 abut the shoulders 98 within the high voltage inserts 90 (Figures 8 and 13A). The collars 110 are frictionally fit within the bores 96 and a tool (not shown) can include a split seam which is receivable over the conductors 238 to apply a force to the rear of the collars 110, which in turn carries the retention clips into the inserts 90. The terminals are then insertable from the rear of the connector and are spring clipped in place, as shown in Figure 13A.

The coaxial pins 190 are retained within their respective apertures by means of retainers 206 which are snapped over the diameter of the coaxial pins 190. The coaxial pins 190 and their retainers 206 are receivable into the assembled inserts 30, 60 to the retained position shown in Figure 16.

As mentioned earlier, a snap ring 230 is placed in the shell 4 within the groove 22 which retains the two inserts 30, 60 in place. It is preferred that the rear of the insert 90 be potted with an appropriate sealing compound to prevent discharge/sparking from the rear of the high voltage terminals. To complete the assembly, the swivel backshell 120 is threaded to the rear of the shell 4 and the two swivel blocks 140 are attached in a surrounding relation with the swivel ball 124. The connector 2 can then be mounted to the base of an aircraft for use with a connector attached to a pilot's helmet.

Finally the shell 120 is threaded to the threaded portion of the housing 4 and the swivel block halves 140 are inserted over the contoured ball portion 124 and are fixed in place. The detent spring members are then assembled to the swivel block halves. If the spring detents 150 are used (Figure 10), each detent assembly is simply inserted into an associated threaded aperture 146, and screwed into the aperture 146 until the ball 152 resides within the V-groove 126 of the swivel block 120. If the alternate detent spring member 150' is used (Figures 15 and 15A) the detent balls 152' are placed within the apertures 146 and the spring clip would be placed around the periphery of the halves 140 with the fingers aligned and projecting into associated apertures 146, thereby spring loading the ball members into the V-groove 126.

The connector 2 is matable with a similar connector 250 shown in Figure 12 which includes polarizing bar 302 which is complementary with the notch 8 in the outer shell 4, and further includ s detents 304 which are complementary with the rollers 21 and spring pins 20 in the outer housing 4. As shown in Figure 12, the connector 300 includes associated apertures 306 for receipt of the high voltage inserts while the pins 320 and 330 extend forwardly from the connector 300 for insertion into the respective apertures within the connector 2.

The above described connector solves the problems found in previous, prior art connectors as the connector is allowed to swivel relative to the aircraft and the connector is retained in a semi-rigid position when not in use making it easy for the pilot to connect the two mating connectors with the use of only one hand. With reference to Figure 15, the connector 2 is shown in the free state without exterior forces on the connector causing the connector to swivel. When a force causes the connector to swivel, for example if the pilot is ejected, the ball and socket joint will allow the connector to swivel, as shown in phantom in Figure 15. When the force is no longer exerted on the connector, the spring detents 150 or 150' within the V-groove 126 will be spring loaded against the V-groove thereby forcing the connector to return to an upstanding condition, where the detent balls will reside within the center of the V-groove. It should be appreciated that by allowing the connector 2 to swivel, when an axial or tensile force is placed on the connector 300, the instant invention prevents any locking or jamming of the two mated connectors during their disconnection. Furthermore, by allowing the connector 2 to return to its upright position when no force is placed upon the two connectors, the pilot can install the connector 300 to the connector 2 with only one hand as the connector will always be facing upwards towards him or her.

As shown in Figure 16, a second embodiment of a breakaway electrical connector 401 comprises a housing in the form of a forward, metallic, circular cross section, shell 400 having therein a forward dielectric insert 402 and a rear dielectric insert 404 secured in the housing 400 by means of a snap ring 406. As shown in Figures 18 and 19, the inserts 402 and 404, cooperate in turn to secure, electrical terminals 408 in the shell 400 these being data terminals. There are secured in the inserts 402 and 404, high voltage power terminal inserts 410 and carrying high voltage el ctrical power terminals 412, the terminals 408 and 412 being crimped to electrical leads L1. The shell 400 has a forward shroud 414 formed with a keying or polarizing notch 418, and rearwardly of the shroud 414 pairs of blocks 420, on diametrically opposite sides of the shell 400 each supporting a spring pin 422 on which is a roller 424 projecting into the shell 400. About its r arward margin, the shell 400 is formed with an external peripheral screw thread 428. As shown in Figures 20 and 21, the breakaway connector 401 further comprises a cable conduit 428, which like the shell 400 is of circular cross section and is made of metal. The conduit 428 has a mount part 430 and a stem 431 comprising a frusto-conical transition part 432 which tapers away from the part 430 and, extending from the smaller end of the part 432, a cable lead out part 434. The parts 430 and 432 cooperating to define an annular shoulder 436 which faces away from the shell 400. The conduit 428 is coupled to the shell 400 by means of an internally screw threaded ring 438 having finger grips 440 (Figure 20), the ring 438 meshing with the screw thread 426 of the shell 400 and having an annular rearward flange 440 engaging an annular forward flange 442 of the mouth part 430 to secure the conduit 428 to the shall 400, when the right 438 has been screwed home. The cable lead out part 434 has fitted thereabout and spaced substantially rearwardly of the transition part 432, an annular support flange 444 secured tightly between a smaller annular flange 446 formed integrally with the part 434 and a removable pin 448 passed through opposed openings in the cable lead out part 434. The connector 401 further comprises a resilient annulus in the form of an elastomeric boot 450 having a generally rectangular, annular rear connecting part 452 bonded into a complementary recess 454 in the flange 444, and a forward annular, generally rectangular, connecting part 456. The boot 450 has peripheral annular corrugations 457. As indicated in broken lines in Figures 20 to 22, the leads L1 extending from the terminals 408 and 412 are enclosed in a cable jacket J passing through the cable conduit 428.

The breakaway connector 401 is assembled to a base B, which is shown in fragmentary from in Figures 20 to 23, with the flange 444, and thus the boot 450, removed, and the cable conduit 428 secured to the shell 400 by means of the ring 438. The cable lead out part 434 is inserted through an opening O in the base B which is, in the present example, the floor of an aircraft fight deck or a vertical pressure bulkhead bounding the flight deck; until the annular shoulder 436 in the opening O which must be dimensioned so that there is clearance between said forward portion and the edge of the opening O. The flange 444 is then threaded on to the part 434 so as to abut the flange 446 and the pin 448 is then pushed through the openings in the part 434 to secure the flange 444 in position. The part 456 is then bonded to the opposite side of the

base B, that is to say its lower side as seen in Figures 20 to 23.

A mating electrical connector 460 for the breakaway connector 401 comprises, as shown in the Figures 17 to 19, a housing in the form of a metal shell 462 having a forward shroud 464 for reception in the shroud 414 of the shell 400 and being formed with opposite detents 466 (only one of which is shown) for cooperation with the rollers 424 to retain the connectors 401 and 460 in mating relationship. Spaced back from the shroud 464, the shell 462 is formed with a keying or polarizing bar 468 which is complementary with the notch 418 in the shroud 414, so that the connectors can only be mated in their correct relative angular positions. Secured in the shell 462, are dielectric inserts 470 and 472 in which are in turn secured, electrical data terminals 474 for mating with the terminals 408 in the shell 400. Secured in the inserts 470 and 472 are high voltage terminal inserts 476 carrying terminals 477 for mating with the terminals 412 in the housing 400. The terminals of the connector 460 are crimped to leads L2 which extend through a frusto-conical rear end cap 476 releasably secured to the shell 462, into a cable jacket J2 which extends rearwardly from the cap 476 and to which is attached a lanyard LA which is connected to the harness of the pilot of the aircraft. The leads L2 extend to the pilots helmet for the supply to power and data to electrical equipment therein.

Figure 18 shows the breakaway connector 401 and the mating connector 460 in partially mated relationship with the bar 468 on the shell 462 about to enter the groove 418 of the shroud 414, whilst Figure 19 shows the connectors 401 and 460 in their fully mated position in which the bar 468 is received in the groove 418 and the rollers 424 are engaged in the detents 466.

As will be appreciated from Figures 18 and 19, the shell 462 of the mating connector 460 is, in the fully mated condition of the connector 401 and 460, deeply engaged in the shell 400 of the breakaway connector 401 and is releasably locked thereto by means of the rollers 424 and detents 466. The connectors 401 and 460 can only be mated and disconnected, therefore, along a particular mating and disconnection axis A - A which is in fact the central longitudinal axis of the two connectors.

Figure 21 shows the housing 400 a position in which it is aligned by means of the resilient annular 450 so that it extends normally of the base B with the shoulder 436 resting thereon in full surface to surface contact therewith. In this position of the breakaway connector 401, the pilot can readily and with one hand, mate the connector 460 with the connector 401 along the axis A - A, since the pilot will be aware of the exact angular position of the breakaway connector 401. Should the pilot eject tensile force will be exerted upon the connector 460, since the lanyard LA is attached to the pilot's harness, this tensile force having a substantial lateral component. By virtue of the resilience of the annulus 450 and the fact that the part 432 of the conduit 428 passes with clearance through opening O in the base B, the breakaway connector will be tilted laterally, in the sense shown, for example, in Figure 22, about the shoulder 438 which cooperates with the base B to provide what is in effect, a hinge, so that the breakaway connector 401 swivels with respect to the base B so as to align it with the axis A - A. Thus the connector 460 readily disconnects from the breakaway connector 401 without impeding the ejection of the pilot, the annulus 450 acting to some extent as a shock absorber. The clearance between the part 432 and the edge of the opening O in the base B is preferably such that the breakaway connector can tilt through 60°, that is to say through 30° in any direction. Since the annulus 450 is bonded both to the flange 444 and to the base B, the breakaway connector cannot rotate about its own axis whereby any winding up of the pilot's harness is avoided. Also, when the connectors 401 and 460 are to be mated, the groove 418 is always oriented in the same angular position about the axis A - A, which also facilitates ready mating of the connectors by the pilot.

A metal spring 480, as shown in Figure 23, should be enrobed in the annulus 450 where the breakaway connector 401 is to be subjected to severe changes in temperature, since the performance of a metal spring is less likely to be affected thereby than that of an elastomeric material. In the interest of simplicity, the annulus 450 could be omitted and a resilient annulus in the form of the helical spring 480 be arranged to act between the flange 444 and the base B, preferably being fixed to both of these.

Claims

1. A breakaway electrical connector (2) for quick disconnection from a mating electrical connector (250) along a disconnection axis, the breakaway connector (2) comprising a housing (4) having secured therein electrical terminals (160, 190) for mating with electrical terminals (320, 330) of the mating connector (250) and means (120, 140) for mounting the housing (4) to a base so that the housing (4) is movable with respect thereto, said mounting means including means (120, 140) to allow the breakaway connector (2) to swivel, thereby aligning a longitudinal axis of the breakaway connector (2) with said disconnection axis; characterized in that said swivel means (120, 140) includes

means (126, 143, 144, 146, 150, 450) to resiliently bias the connector (2) into a predetermined position.

2. A breakaway connector according to claim 1, characterized in that the means allowing the connector to swivel comprises a ball and socket joint (124, 140).

3. A breakaway connector according to claim 2, characterized in that the housing includes a two part metallic shell, a first part of which comprises an elongate tube (4) which surrounds said terminals (160, 190) and a front end (6) of which provides a front mating face, the rear end of the elongate tube including a second part in the form of a second metallic component (120) affixed thereto and which includes a ball (124) formed integrally with said second metallic component (120); and in that the mounting means comprises a flanged socket (140) surrounding said ball (124) which allows the housing (4, 120) and the ball (124) to swivel within the socket (140).

4. A breakaway connector according to claim 2 or 3, characterized in that the ball (124) includes a detent (126) at least partially extending therearound and the socket (140) includes spring means (150) located within said detent (126) to bias said longitudinal axis of said breakaway connector (2) in a predetermined direction.

5. A breakaway connector according to claim 4, characterized in that the socket (140) includes spring members (150 or 156') which project towards the detent (126).

6. A breakaway connector according to claim 1, characterized in that the means for allowing the connector (401) to swivel, comprises a resilient annulus (450) extending about said longitudinal axis for urging the housing (400, 428) against the base (8).

7. A breakaway connector according to claim 5, characterized in that the resilient annulus is in the form of an elastomeric boot (450), or a helical metal spring (480), or a helical metal spring (480) enrobed in an elastomeric boot (450).

8. A breakaway connector according to claim 6 or 7, characterized in that the housing 400, 428) has a shoulder (436) for engaging one side of the base (B) and a stem (431) projecting from the shoulder (436) and supporting the resilient annulus (450) for engagement with the opposite side of the base (B).

9. A base mounted breakaway electrical connector (401) for quick disconnection from a mating electrical connector (460) along a disconnection axis (A), the breakaway connector (401) comprising a housing (400, 428) having secured therein, electrical terminals (408, 410) for mating with electrical terminals (474, 477) of the mating connector (460), the housing (400, 428) being mounted to a base (B) by means (450) allowing the housing (400, 428) to move with respect thereto; characterized in that the mounting means comprises a resilient annulus (450) extending about a longitudinal axis of the breakaway connector; and in that the housing has a shoulder (438) engaging one side of the base (B) and a stem (431) projecting with clearance through an opening (O) in the base (B),, the resilient annulus (450) surrounding the stem (431) and being fixed between the stem (431) and the opposite side of the base (B) thereby to align the connector (401) with the disconnection axis (A).

10. A breakaway connector according to claim 9, characterized in that the stem (431) forms part of a cable conduit (428), accommodating electrical leads (L1) connected to the terminals (408, 410) in the housing (400,428) the resilient annulus (450) being supported on a removable flange (444) surrounding the stem (431), and the cable conduit (428) being removably attached to the remainder (400) of the housing (400, 428).

Patentansprüche

1. Ausreißbarer elektrischer Verbinder (2) für schnelles Trennen von einem zugehörigen elektrischen Verbinder (250) entlang einer Trennachse, wobei der ausreißbare Verbinder (2) ein Gehäuse (4) mit darin gesicherten elektrischen Anschlüssen (160, 190) für das Eingreifen mit elektrischen Anschlüssen (320, 330) des zugehörigen Verbinders (250) und Mittel (120, 140) aufweist, um das Gehäuse (4) an einer Basis zu montieren, so daß das Gehäuse (4) in bezug auf diese beweglich ist, wobei die Montagemittel Mittel (120, 140) aufweisen, um ein Schwenken des ausreißbaren Verbinders (2) zu erlauben, wodurch eine Längsachse des ausreißbaren Verbinders (2) mit der Trennachse ausgerichtet wird;

dadurch gekennzeichnet, daß die Schwenkmittel (120, 140) Mittel (126, 143, 144, 146, 150, 450) aufweisen, um den Verbinder

(2) federnd in eine vorbestimmte Position vorzuspannen.

2. Ausreißbarer Verbind r nach Anspruch 1, dadurch gekennzeichnet, daß die Mittel, die ein Schwenken des Verbinders erlauben, ein Kugelgelenk (124, 140) aufweisen.

3. Ausreißbarer Verbinder nach Anspruch 2, dadurch gekennzeichnet, daß das Gehäuse eine zweiteilige metallische Hülle aufweist, deren erster Teil ein längliches Rohr (4) aufweist, das die Anschlüsse (160, 190) umgibt und dessen vorderes Ende (6) eine vordere Führungsfläche bereitstellt, wobei das rückwärtige Ende des länglichen Rohres einen zweiten Teil in der Form einer zweiten, hieran angehängten, metallischen Komponente (120) aufweist, die eine in einem Stück mit der zweiten metallischen Komponente (120) geformte Kugel (124) einschließt;

und daß die Montagemittel eine mit einem Flansch versehene Buchse (140) aufweisen, die die Kugel (124) umgibt, was es dem Gehäuse (4, 120) und der Kugel (124) erlaubt, in der Buchse (140) zu schwenken.

4. Ausreißbarer Verbinder nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß die Kugel (124) einen Anschlag (126) aufweist, der sich zumindest teilweise um diese herum erstreckt, und daß die Buchse (140) Federmittel (150) aufweist, die sich in dem Anschlag (126) befinden, um die Längsachse des ausreißbaren Verbinders (2) in eine vorbestimmte Richtung vorzuspannen.

5. Ausreißbarer Verbinder nach Anspruch 4, dadurch gekennzeichnet, daß die Buchse (140) Federbauteile (150 oder 156') aufweist, die zu dem Anschlag (126) hin vorragen.

6. Ausreißbarer Verbinder nach Anspruch 1, dadurch gekennzeichnet, daß die Mittel, um ein Schwenken des Verbinders (401) zu erlauben, einen federnden Ringkörper (450) aufweisen, der sich um die Längsachse erstreckt, um das Gehäuse (400, 428) gegen die Basis (B) zu zwingen.

7. Ausreißbarer Verbinder nach Anspruch 5, dadurch gekennzeichnet, daß der federnde Ringkörper die Form eines elastomeren Schuhs (450), einer schraubenförmigen Metallfeder (480) oder einer mit einem elastomeren Schuh (450) umkleideten schraubenförmigen Metallfeder (480) hat.

8. Ausreißbarer Verbinder nach Anspruch 6 oder 7, dadurch gekennzeichnet, daß das Gehäuse (400, 428) ein n Absatz (436), um mit einer Seite der Basis (B) in Verbindung zu stehen, und einen Fuß (431) hat, der von dem Absatz (436) vorragt und den federnden Ringkörper (450) für eine Verbindung mit der gegenüberliegenden Seite der Basis (B) trägt.

9. An einer Basis angebrachter ausreißbarer elektrischer Verbinder (401) für schnelles Trennen von einem zugehörigen elektrischen Verbinder (460) entlang einer Trennachse (A), wobei der ausreißbare Verbinder (401) ein Gehäuse (400, 428) mit darin gesicherten elektrischen Anschlüssen (408, 410) für das Eingreifen mit elektrischen Anschlüssen (474, 477) des zugehörigen Verbinders (460) aufweist, wobei das Gehäuse (400, 428) an einer Basis (B) durch Mittel (450) angebracht ist, die ein Bewegen des Gehäuses (400, 428) in bezug auf diese erlauben;

dadurch gekennzeichnet, daß die Montagemittel einen federnden Ringkörper (450) aufweisen, der sich um eine Längsachse des ausreißbaren Verbinders erstreckt;

und daß das Gehäuse einen Absatz (438), der mit einer Seite der Basis (B) in Verbindung steht, und einen Fuß (431) hat, der mit Spielraum durch eine Öffnung (O) der Basis (B) vorragt, wobei der federnde Ringkörper (450) den Fuß (431) umgibt und zwischen dem Fuß (431) und der gegenüberliegenden Seite der Basis (B) fixiert ist, um dadurch den Verbinder (401) mit der Trennachse (A) auszurichten.

10. Ausreißbarer Verbinder nach Anspruch 9, dadurch gekennzeichnet, daß der Fuß (431) Teil einer Kabelführung (428) bildet, die elektrische Leiter (L1) aufnimmt, die mit den Anschlüssen (408, 410) in dem Gehäuse (400, 428) verbunden sind, der federnde Ringkörper (450) auf einem entfernbaren, den Fuß (431) umgebenden, Flansch (444) getragen ist und die Kabelführung (428) entfernbar an dem Rest (400) des Gehäuses (400, 428) befestigt ist.

Revendications

1. Connecteur électrique (2) à désaccouplement rapide destiné à se déconnecter rapidement d'un connecteur électrique complémentaire (250) suivant un axe de déconnexion, le connecteur (2) à désaccouplement rapide comportant un boîtier (4) dans lequel sont fixées des bornes électriques (160, 190) destinées à s'accoupler avec des bornes électriques (320, 330) du connecteur complémentaire

(250) et des moyens (120, 140) pour le montage du boîtier (4) sur une base afin que le boîtier (4) soit mobile par rapport à elle, lesdits moyens de montage comprenant des moyens (120, 140) pour permettre au connecteur (2) à désaccouplement rapide de pivoter, alignant ainsi un axe longitudinal du connecteur (2) à désaccouplement rapide avec ledit axe de déconnexion ; caractérisé en ce que lesdits moyens (120, 140) de pivotement comprennent des moyens (126, 143, 144, 146, 150, 450) pour rappeler élastiquement le connecteur (2) dans une position prédéterminée.

2. Connecteur à désaccouplement rapide selon la revendication 1, caractérisé en ce que les moyens permettant au connecteur de pivoter comprennent une articulation à rotule et douille (124, 140).

3. Connecteur à désaccouplement rapide selon la revendication 2, caractérisé en ce que le boîtier comprend une coque métallique en deux parties, dont une première partie comprend un tube allongé (4) qui entoure lesdites bornes (160, 190) et dont une extrémité avant (6) constitue une face avant d'accouplement, l'extrémité arrière du tube allongé comprenant une seconde partie sous la forme d'une seconde pièce métallique (120) qui lui est fixée et qui comprend une rotule (124) réalisée d'une seule pièce avec ladite seconde pièce métallique (120) ; et en ce que les moyens de montage comprennent une douille (140) à bride entourant ladite rotule (124), qui permet au boîtier (4, 120) et à la rotule (124) de pivoter à l'intérieur de la douille (140).

4. Connecteur à désaccouplement rapide selon la revendication 2 ou 3, caractérisé en ce que la rotule (124) comprend un élément de positionnement (126) s'étendant au moins partiellement autour d'elle et la douille (140) comprend un moyen à ressort (150) placé dans ledit élément de positionnement (126) pour rappeler ledit axe longitudinal dudit connecteur (2) à désaccouplement rapide dans une direction prédéterminée.

5. Connecteur à désaccouplement rapide selon la revendication 4, caractérisé en ce que la douille (140) comprend des éléments à ressort (150 ou 156') qui font saillie vers l'élément de positionnement (126).

6. Connecteur à désaccouplement rapide selon la revendication 1, caractérisé en ce que les moyens destinés à perm ttre au connecteur (401) de pivoter comprennent un anneau élastique (450) s'étendant autour dudit axe longitudinal pour solliciter le boîtier (400, 428) contre la base (B).

7. Connecteur à désaccouplement rapide selon la revendication 5, caractérisé en ce que l'anneau élastique se présente sous la forme d'un manchon élastomérique (450), d'un ressort métallique hélicoïdal (480) ou d'un ressort métallique hélicoïdal (480) enrobé dans un manchon élastomérique (450).

8. Connecteur à désaccouplement rapide selon la revendication 6 ou 7, caractérisé en ce que le boîtier (400, 428) comporte un épaulement (436) destiné à porter contre un côté de l'embase (B) et une tige (431) faisant saillie de l'épaulement (436) et supportant l'anneau élastique (450) pour qu'il porte contre le côté opposé de la base (B).

9. Connecteur électrique (401) à désaccouplement rapide, monté sur une base, destiné à se déconnecter rapidement d'un connecteur électrique complémentaire (460) suivant un axe de déconnexion (A), le connecteur (401) à désaccouplement rapide comportant un boîtier (400, 428) dans lequel sont fixées des bornes électriques (408, 410) destinées à s'accoupler avec des bornes électriques (474, 477) du connecteur complémentaire (460), le boîtier (400, 428) étant monté sur une base (B) par des moyens (450) permettant au boîtier (400, 428) de se déplacer par rapport à elle ; caractérisé en ce que les moyens de montage comprennent un anneau élastique (450) s'étendant autour d'un axe longitudinal du connecteur à désaccouplement rapide ; et en ce que le boîtier comporte un épaulement (438) portant contre un côté de la base (B) et une tige (431) faisant saillie avec du jeu à travers une ouverture (O) dans la base (B), l'anneau élastique (450) entourant la tige (431) et étant fixé entre la tige (431) et le côté opposé de la base (B) afin d'aligner le connecteur (401) avec l'axe de déconnexion (A).

10. Connecteur à désaccouplement rapide selon la revendication 9, caractérisé en ce que la tige (431) fait partie d'un conduit (428) de câble, logeant des conducteurs électriques (L1) connectés aux bornes (408, 410) dans le boîtier (400, 428), l'anneau élastique (450) étant supporté sur une bride amovible (444) entourant la tige (431), et le conduit de câble (428) étant relié de façon amovible à la partie restante (400) du boîtier (400, 428).

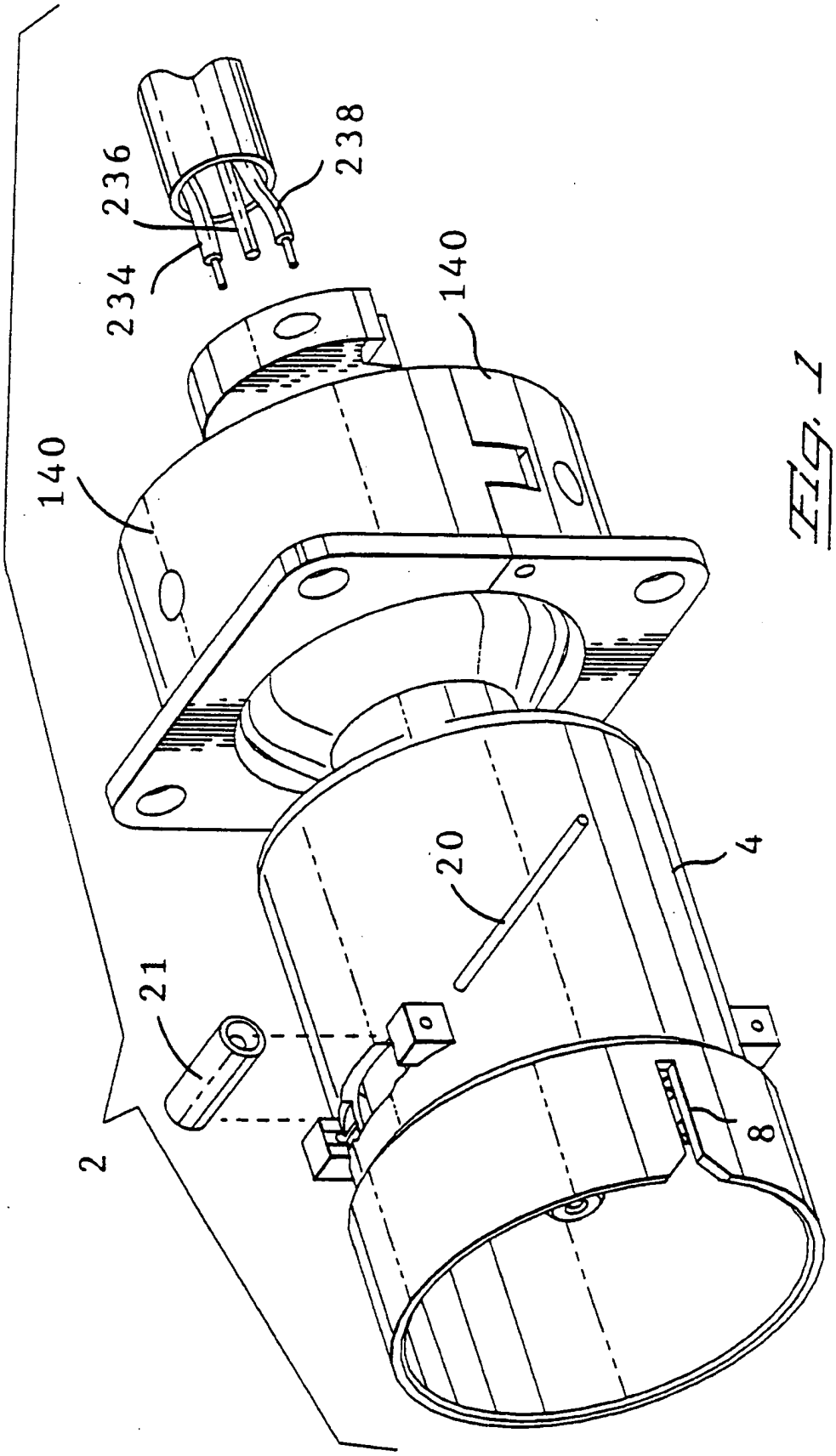

Fig. 1

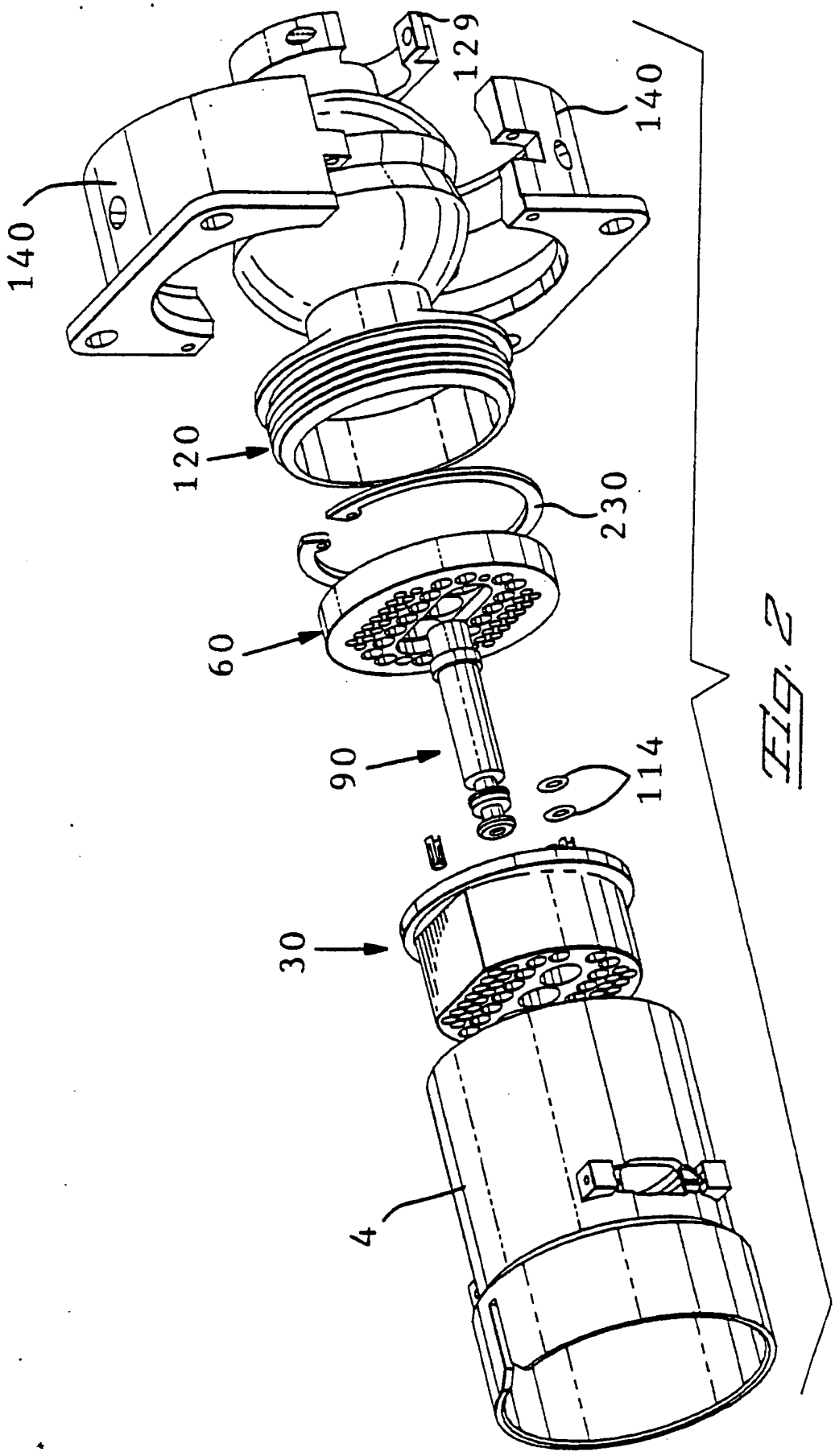

Fig. 2

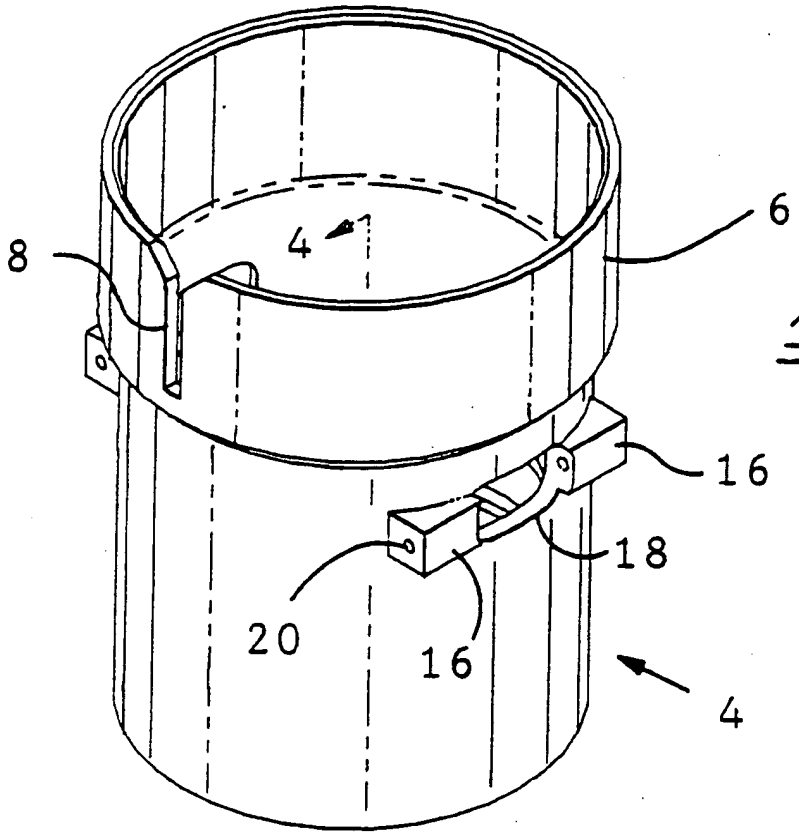

Fig. 3

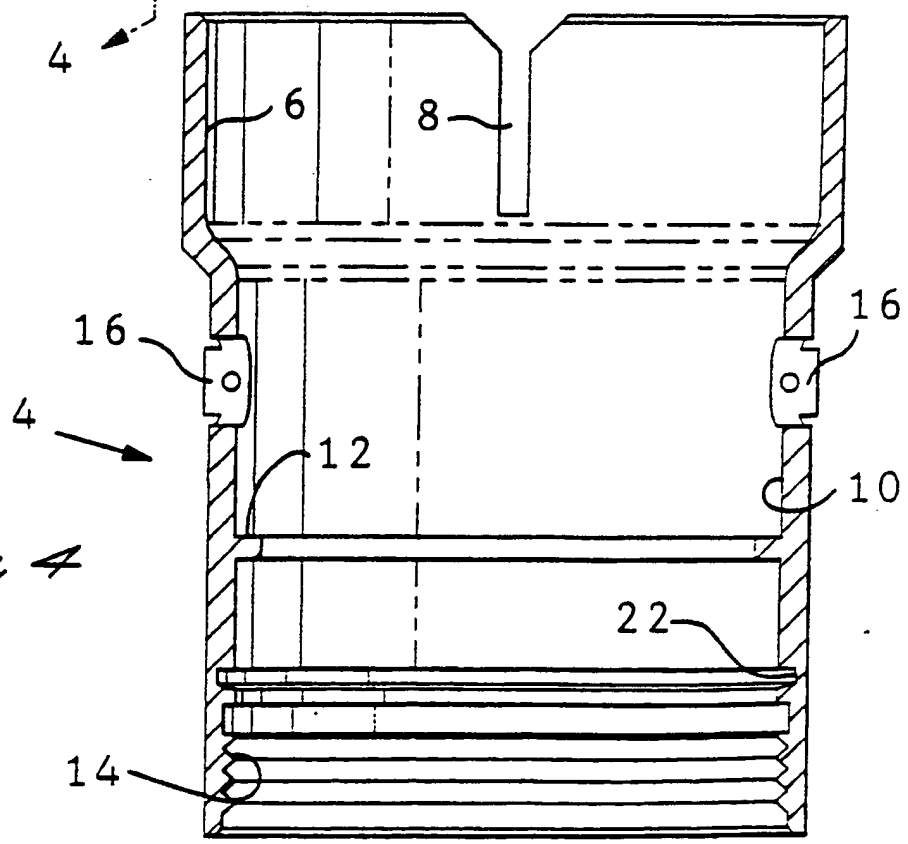

Fig. 4

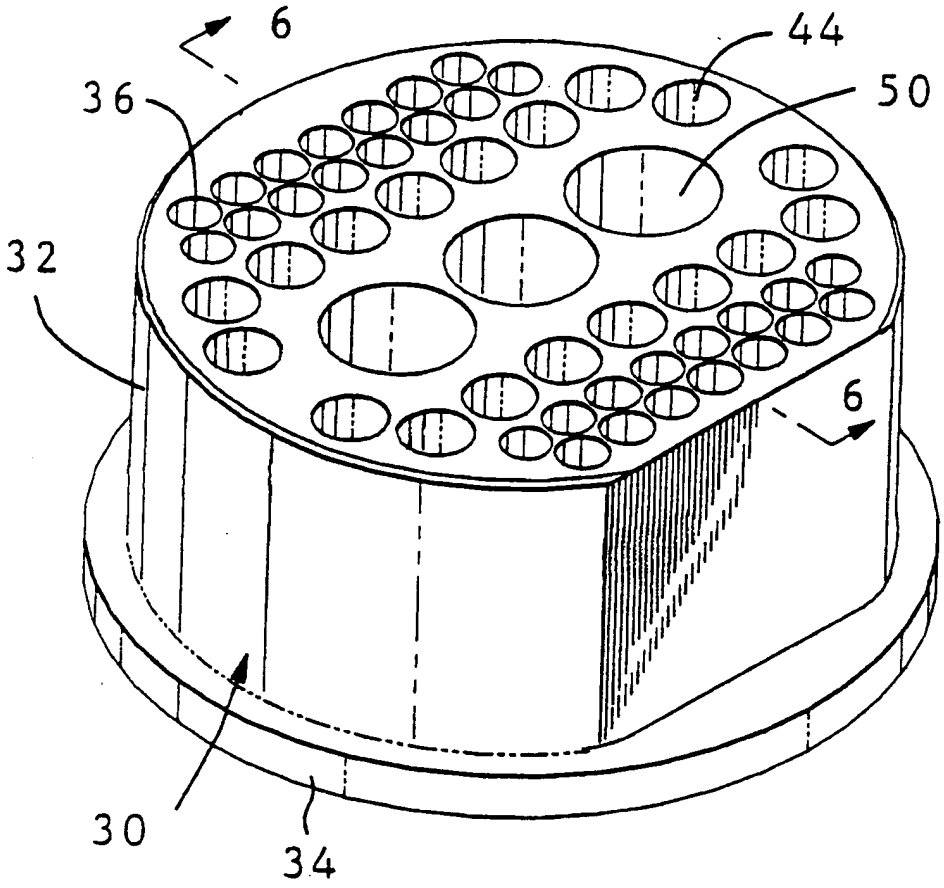

Fig. 5

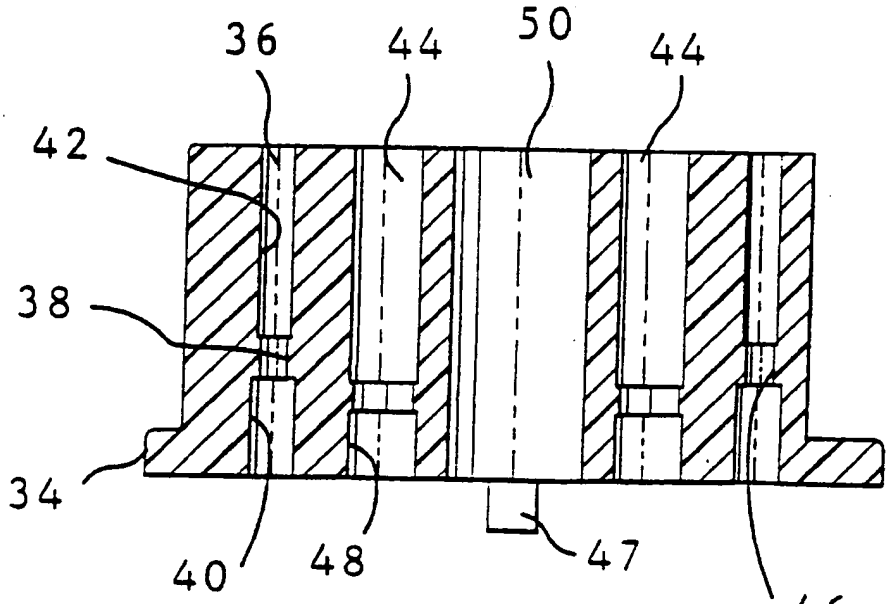

Fig. 6

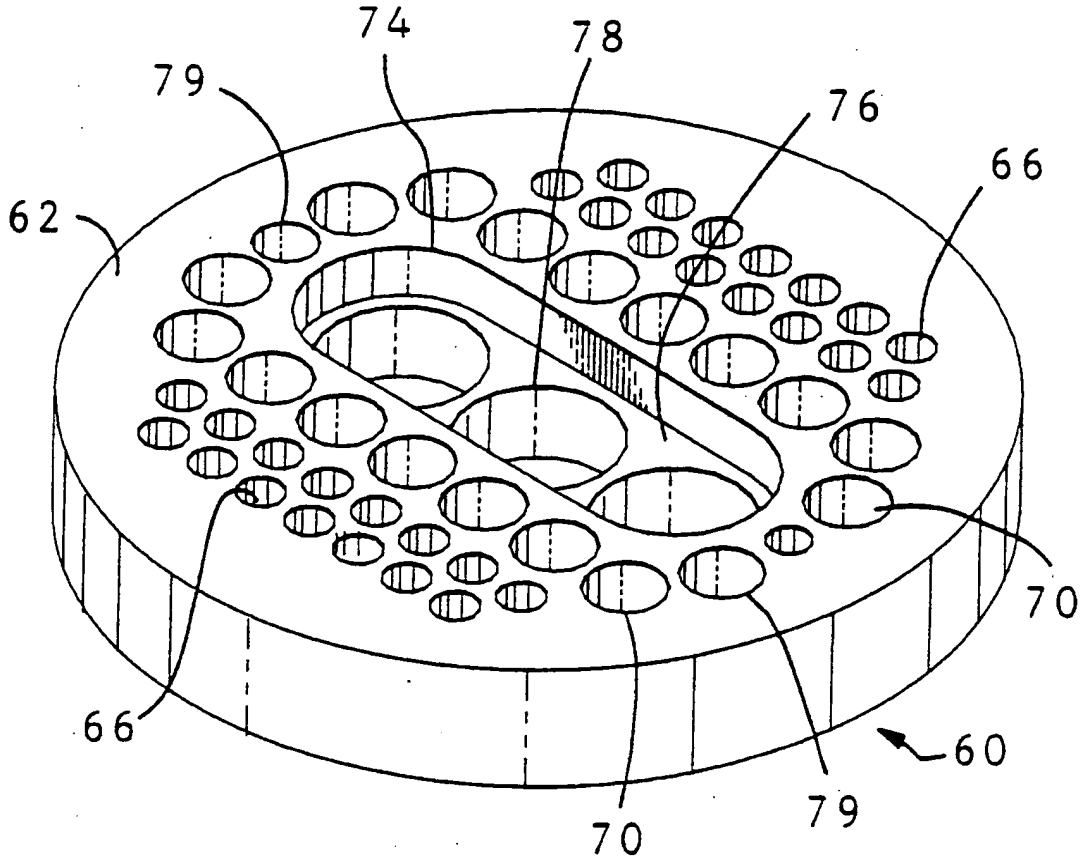

Fig. 7

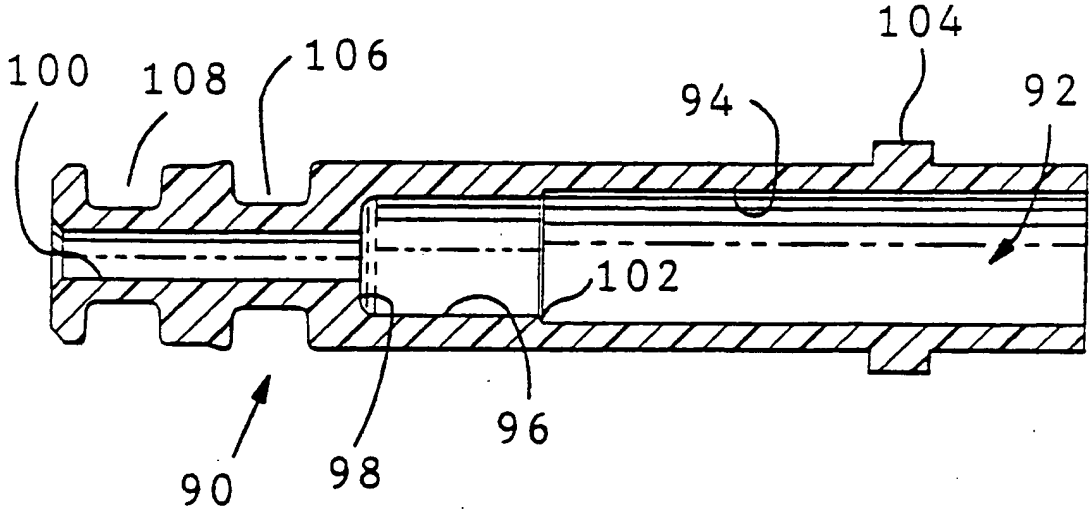

Fig. 8

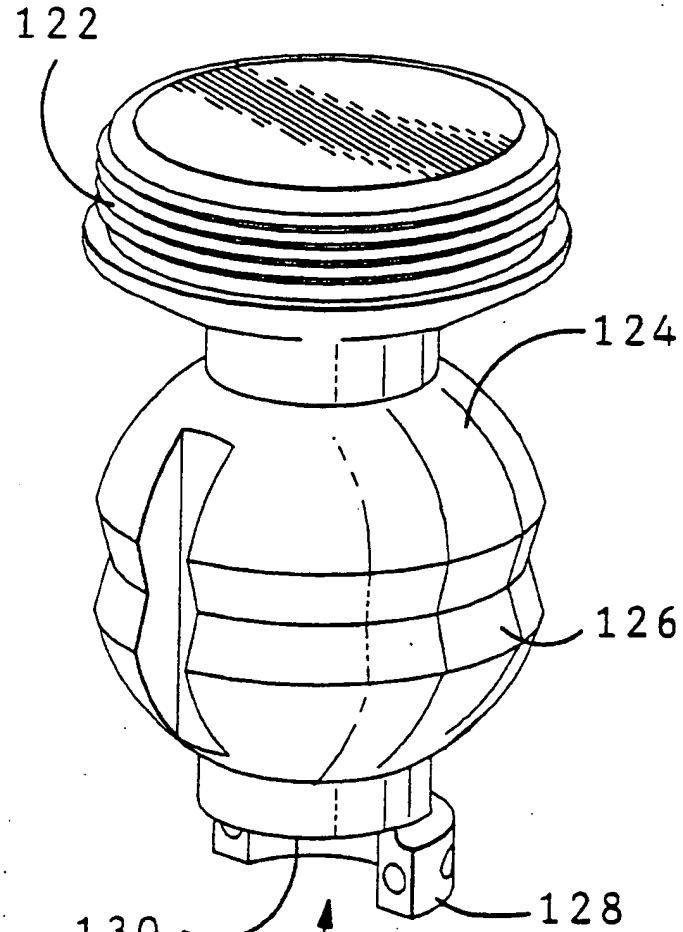

Fig. 9

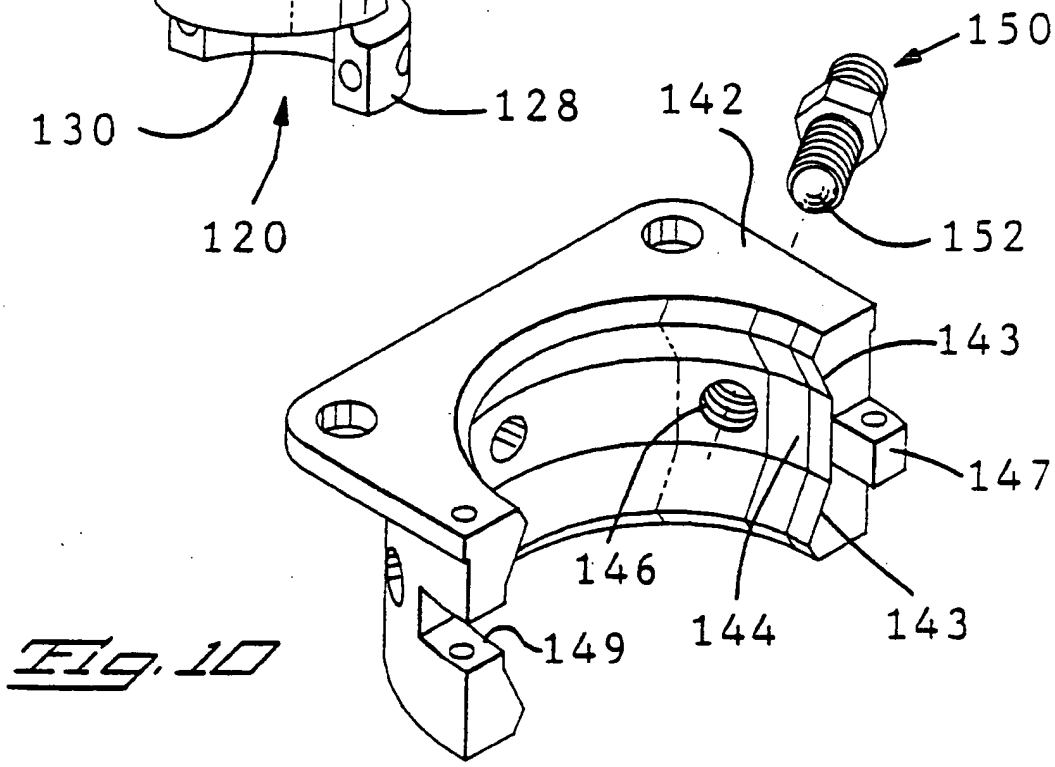

Fig. 10

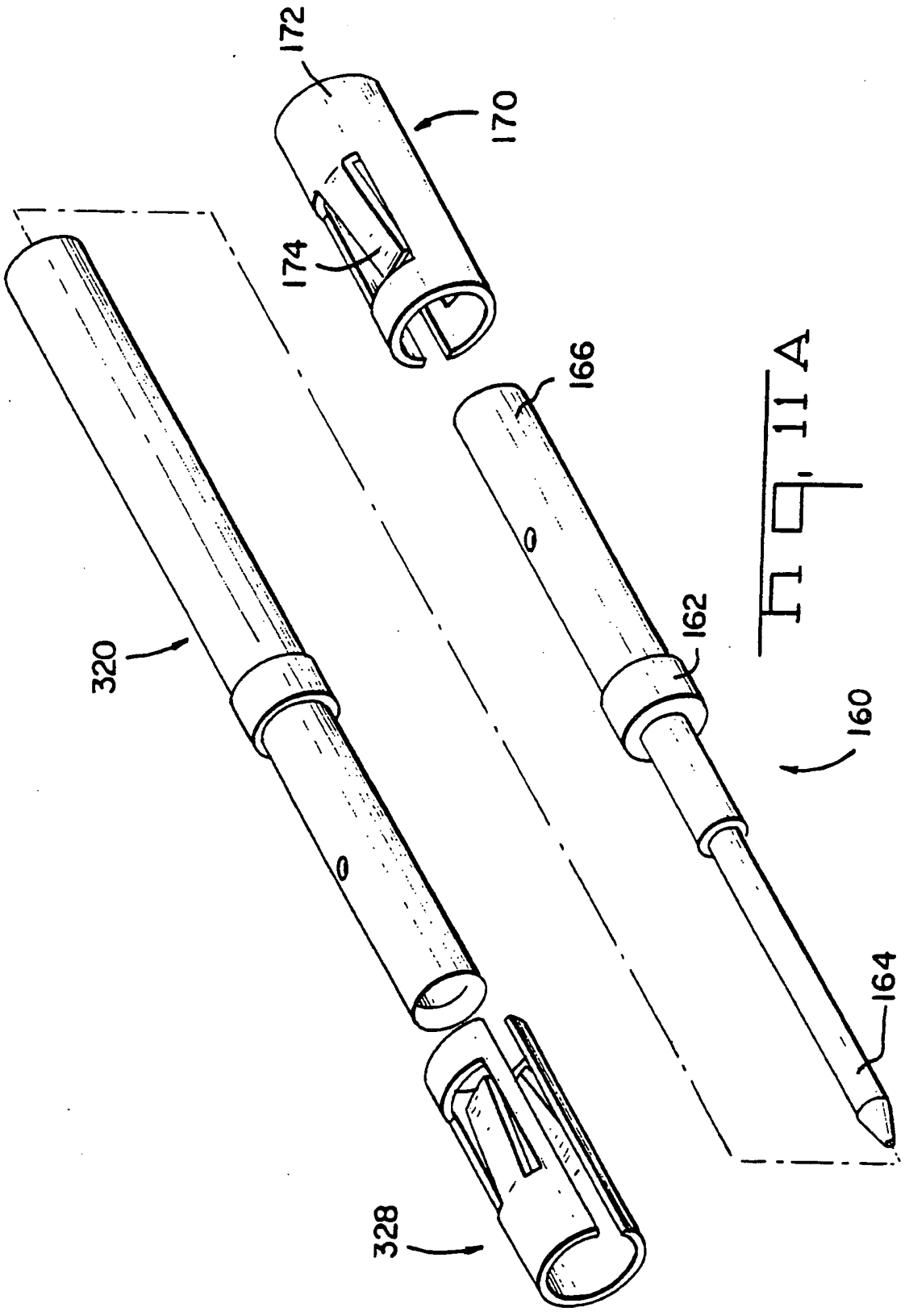

FIG. 11A

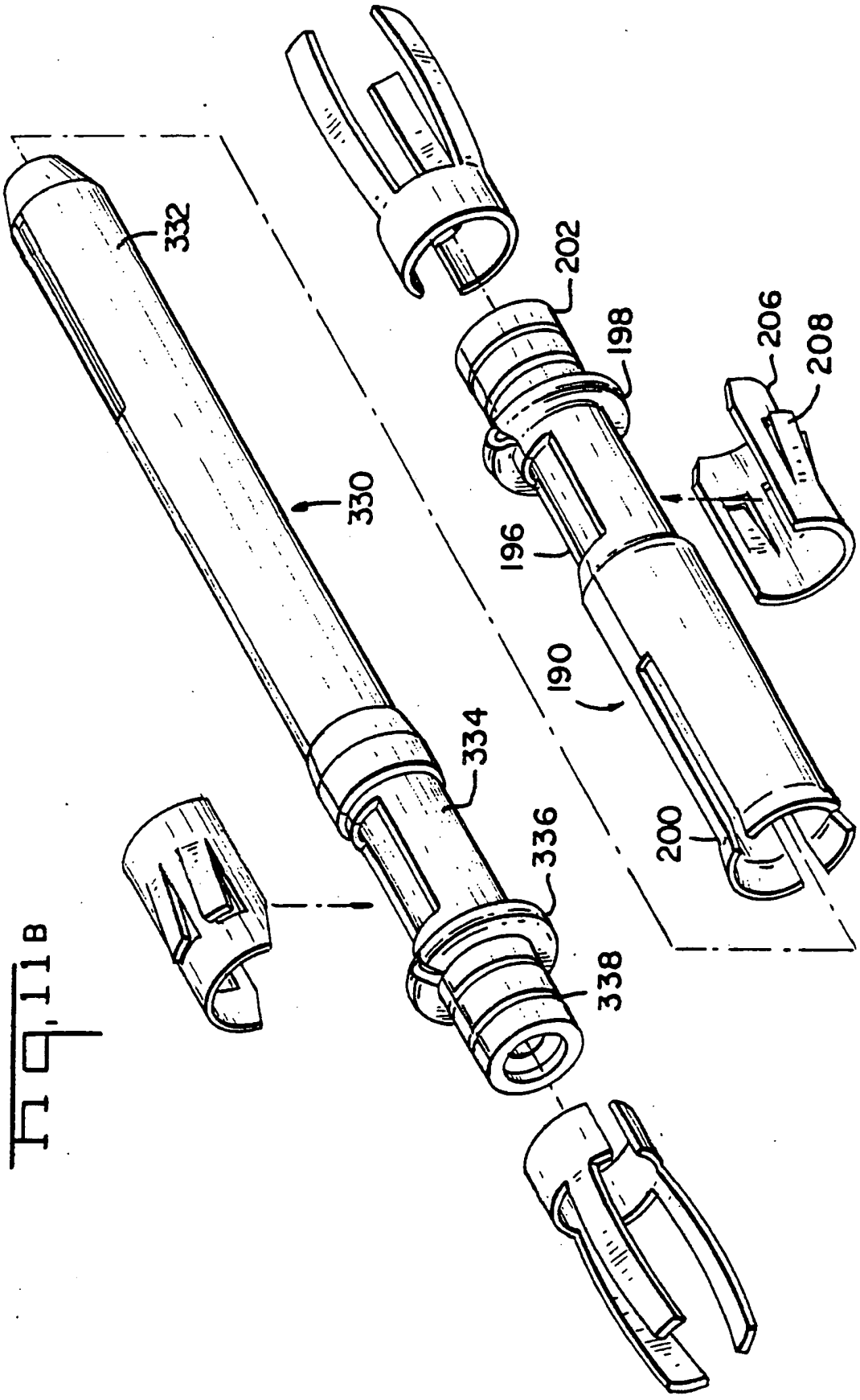

FIG. 11B

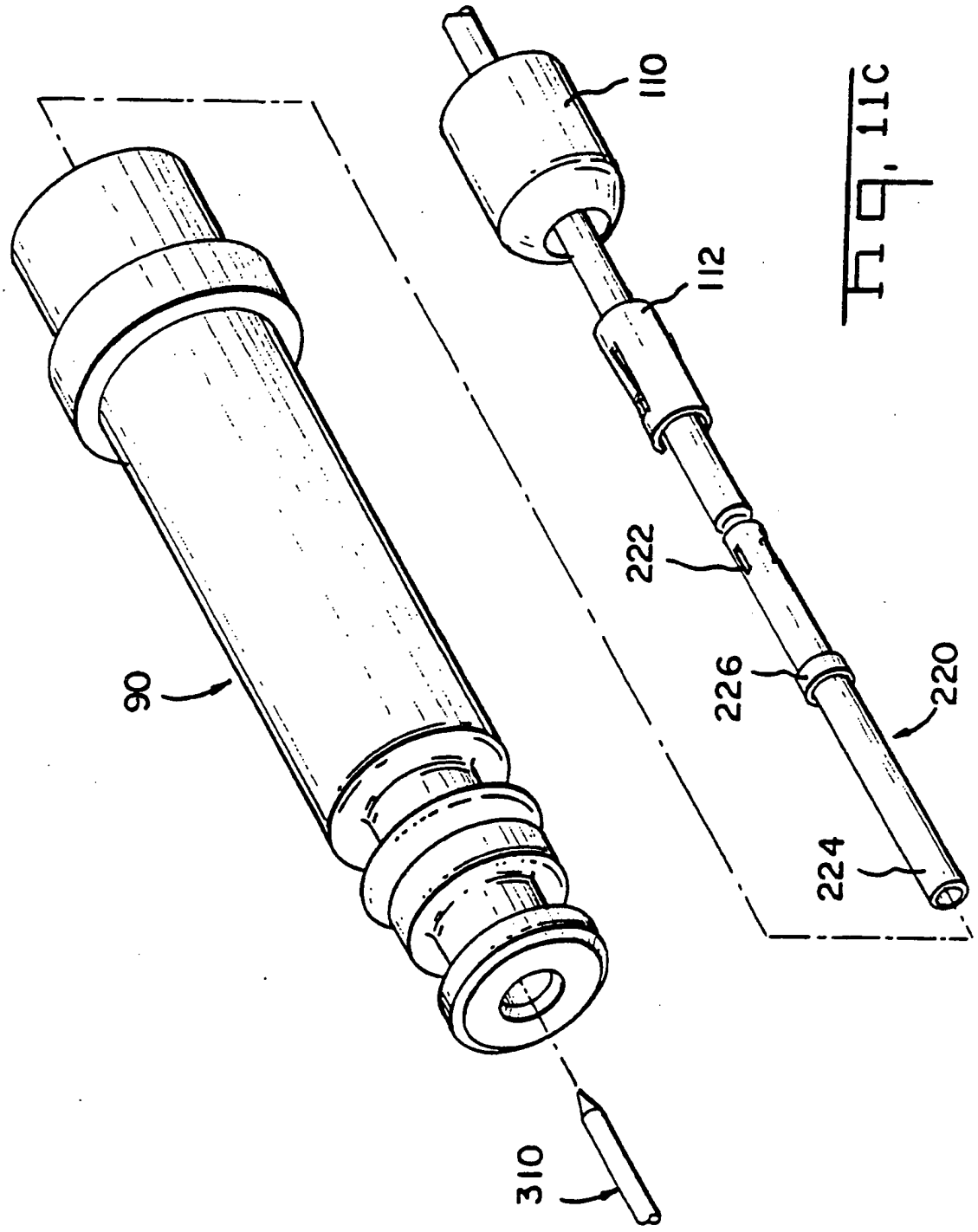

Fig. 11c

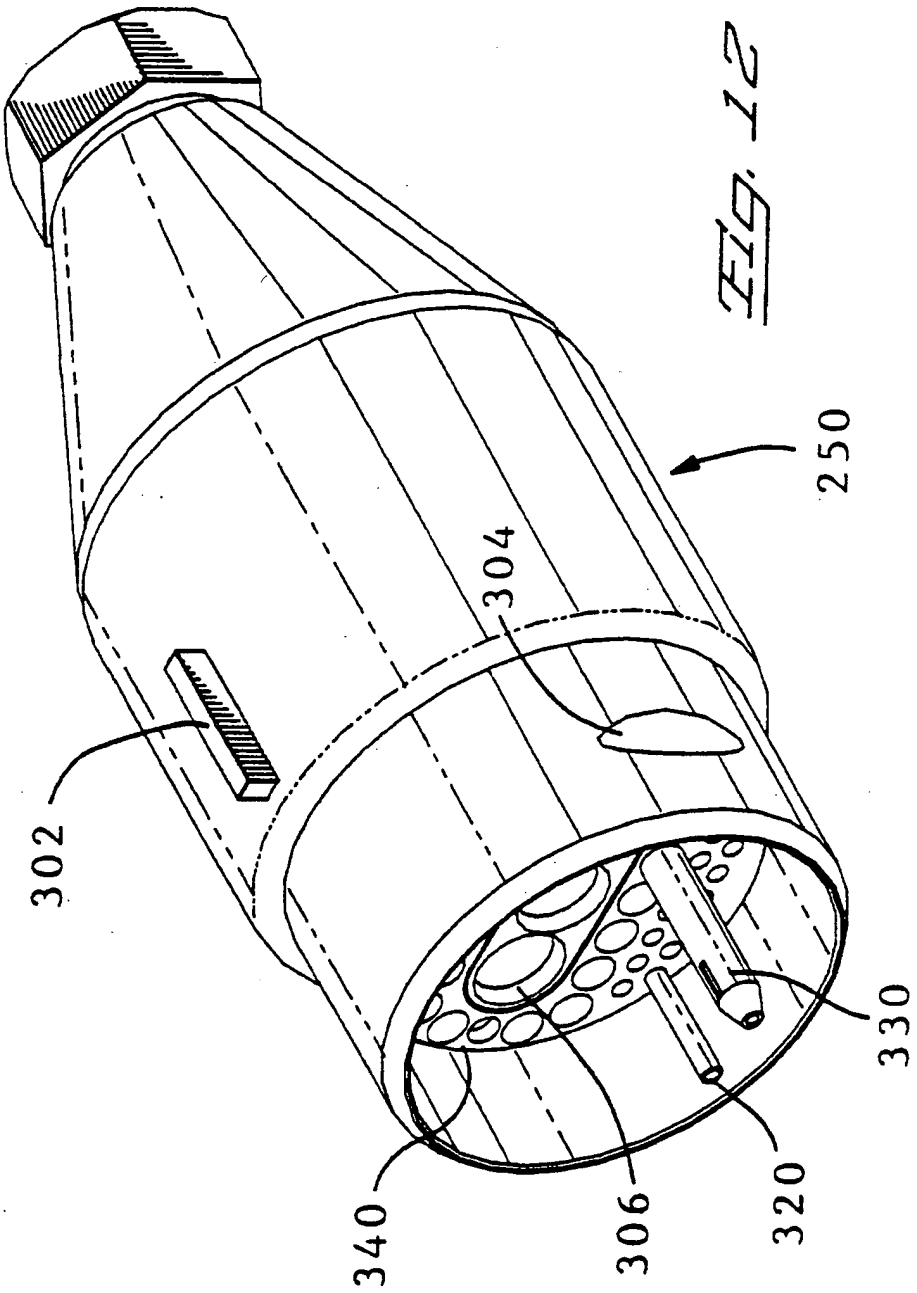

Fig. 12

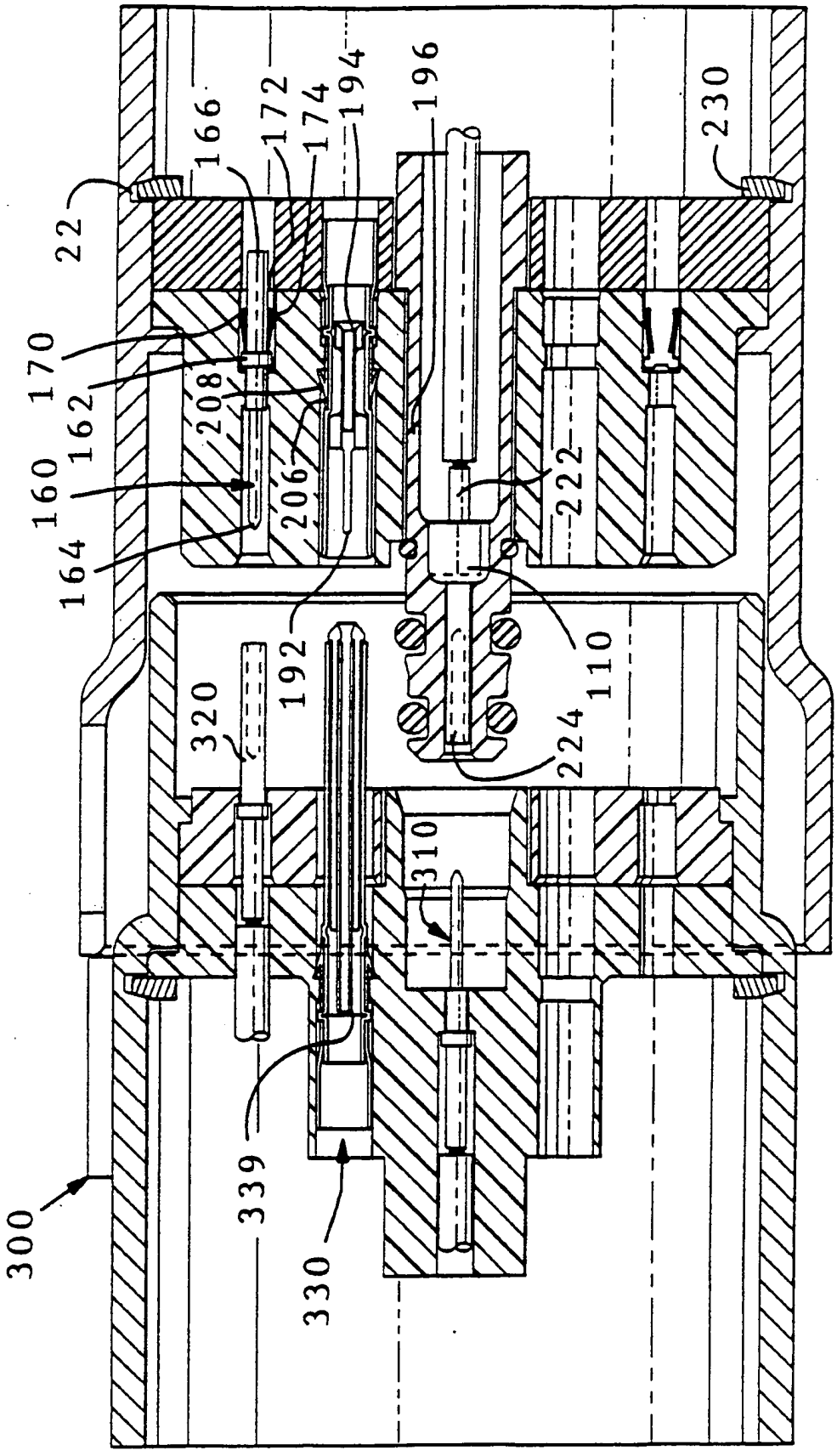
166
172
174
194
196
230
22
170
162
160
164
208
206
222
192
110
224
320
310
339
330
300

Fig. 17

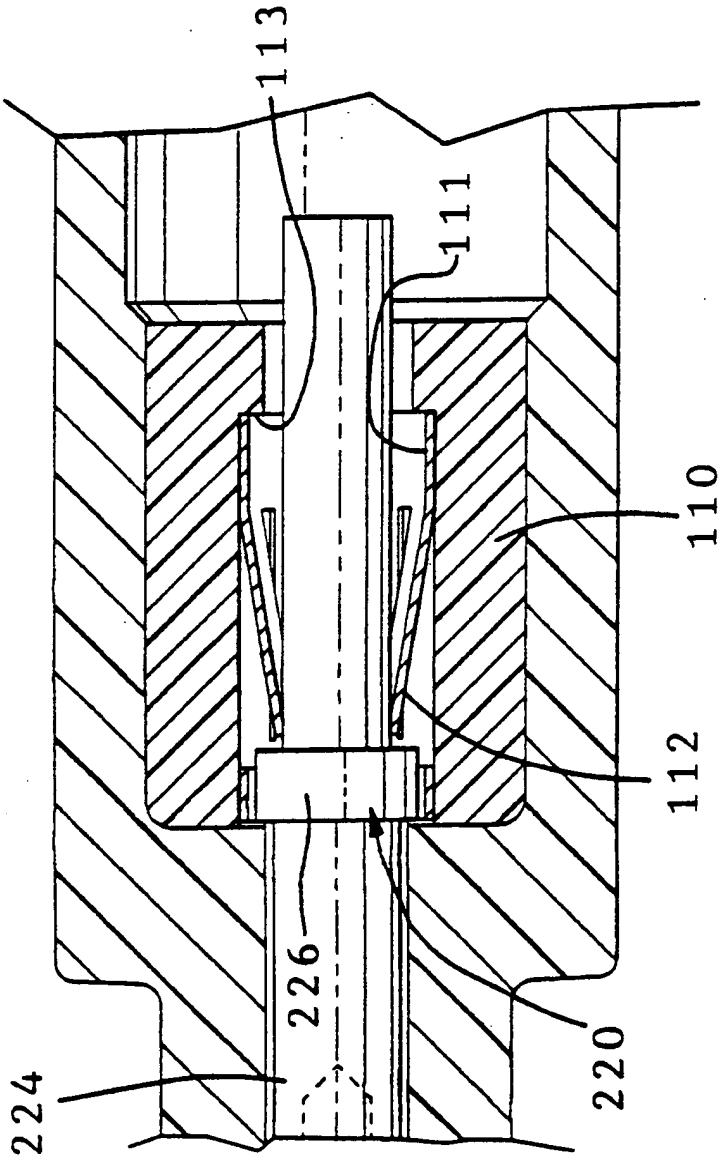

Fig. 13A

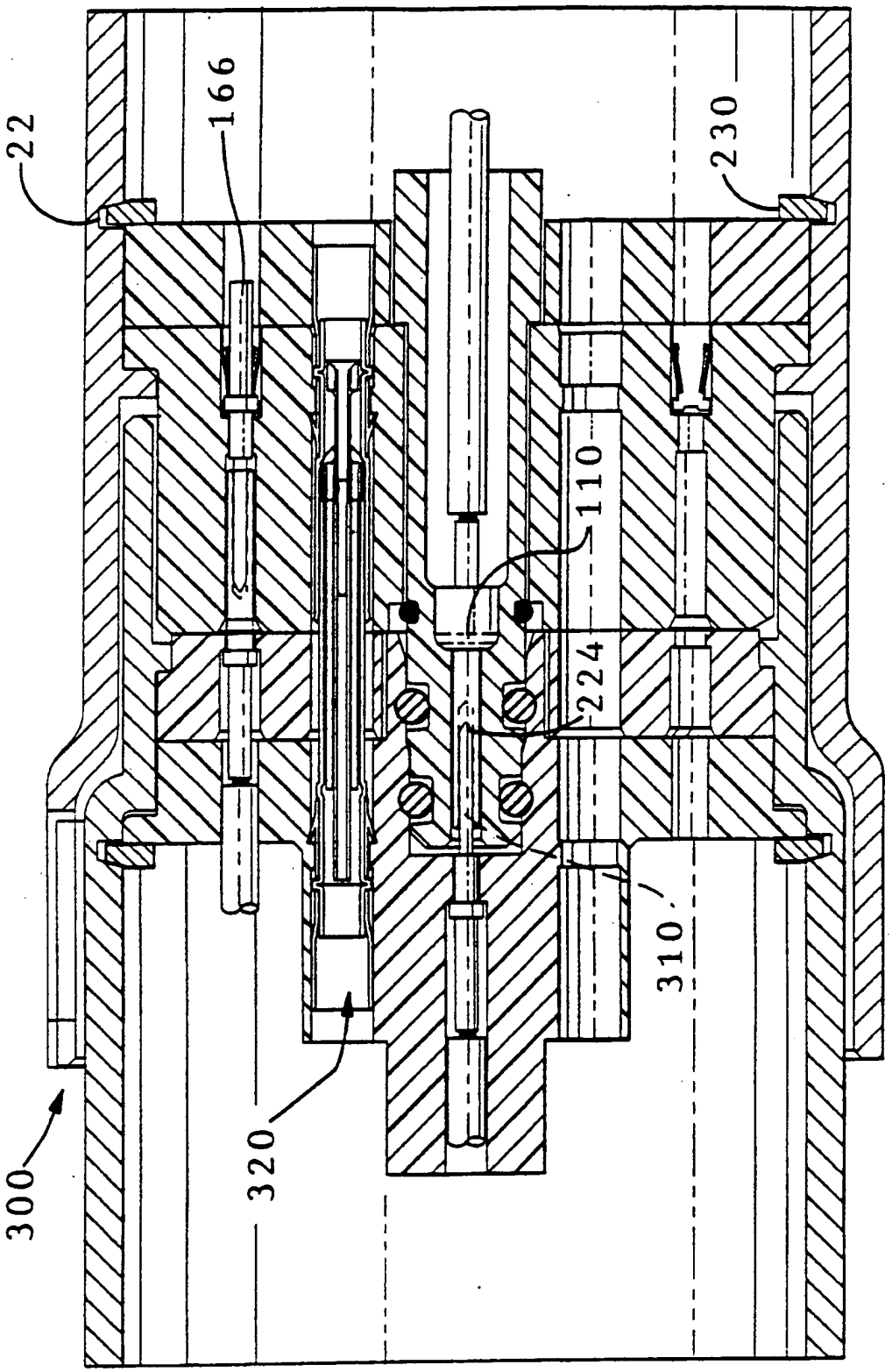

Fig. 14

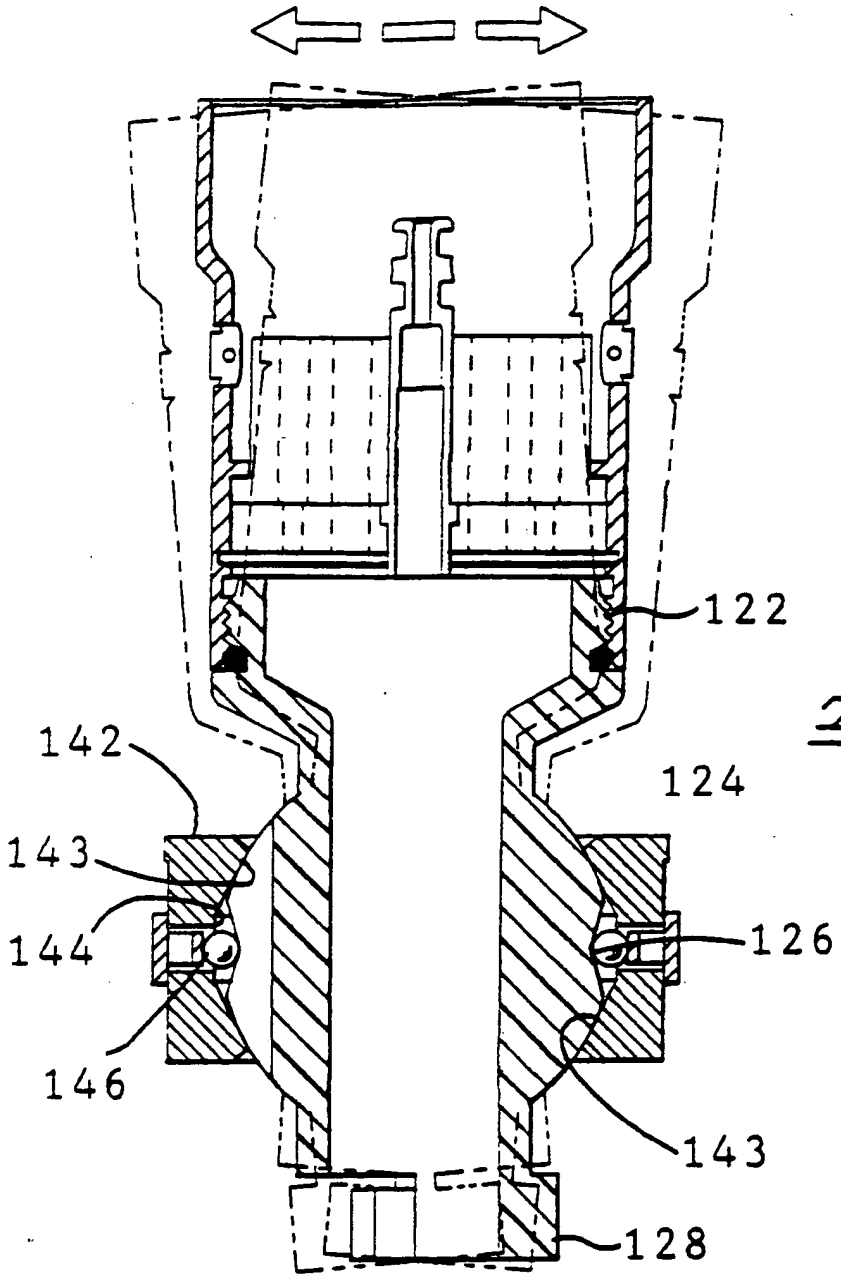

Fig. 15

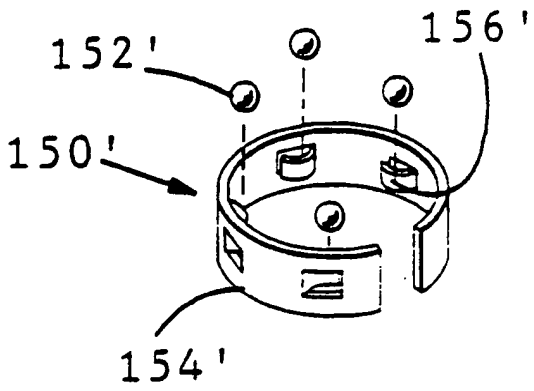

Fig. 15A

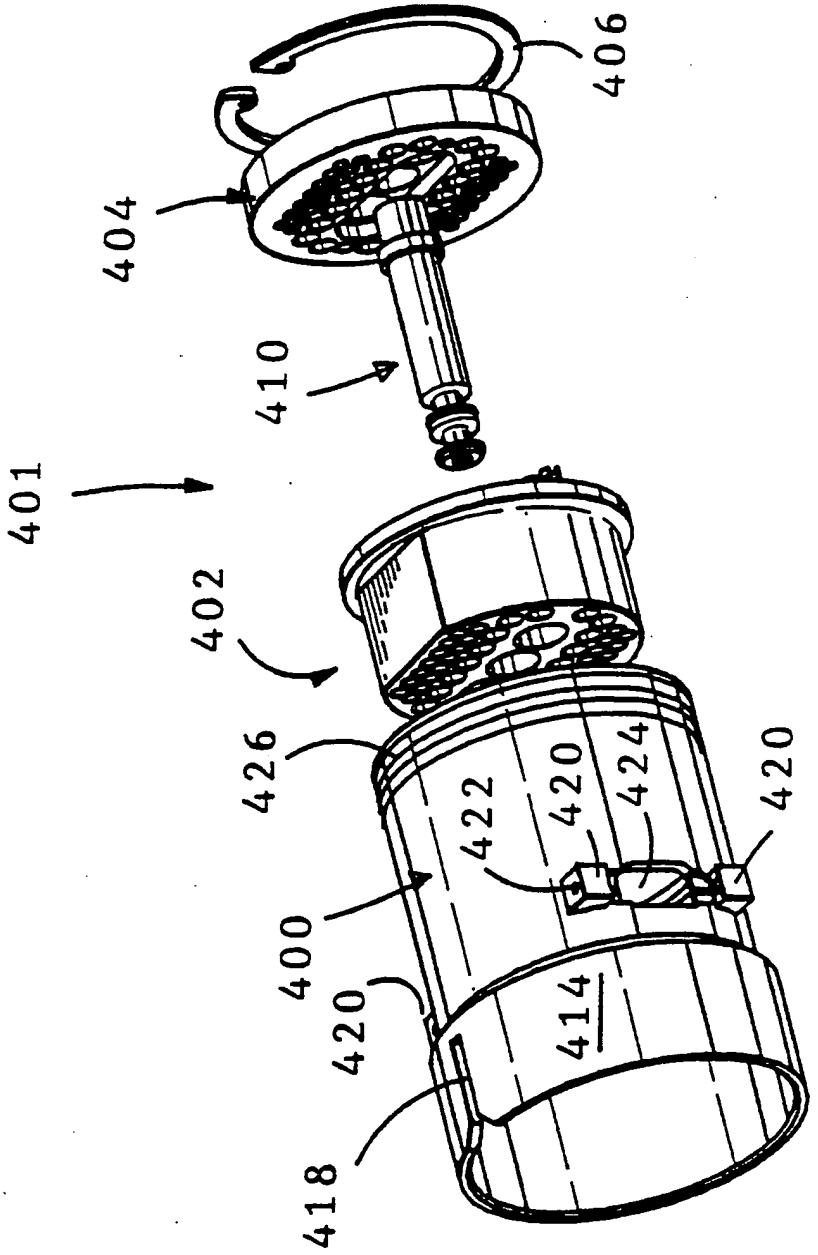

Fig.16

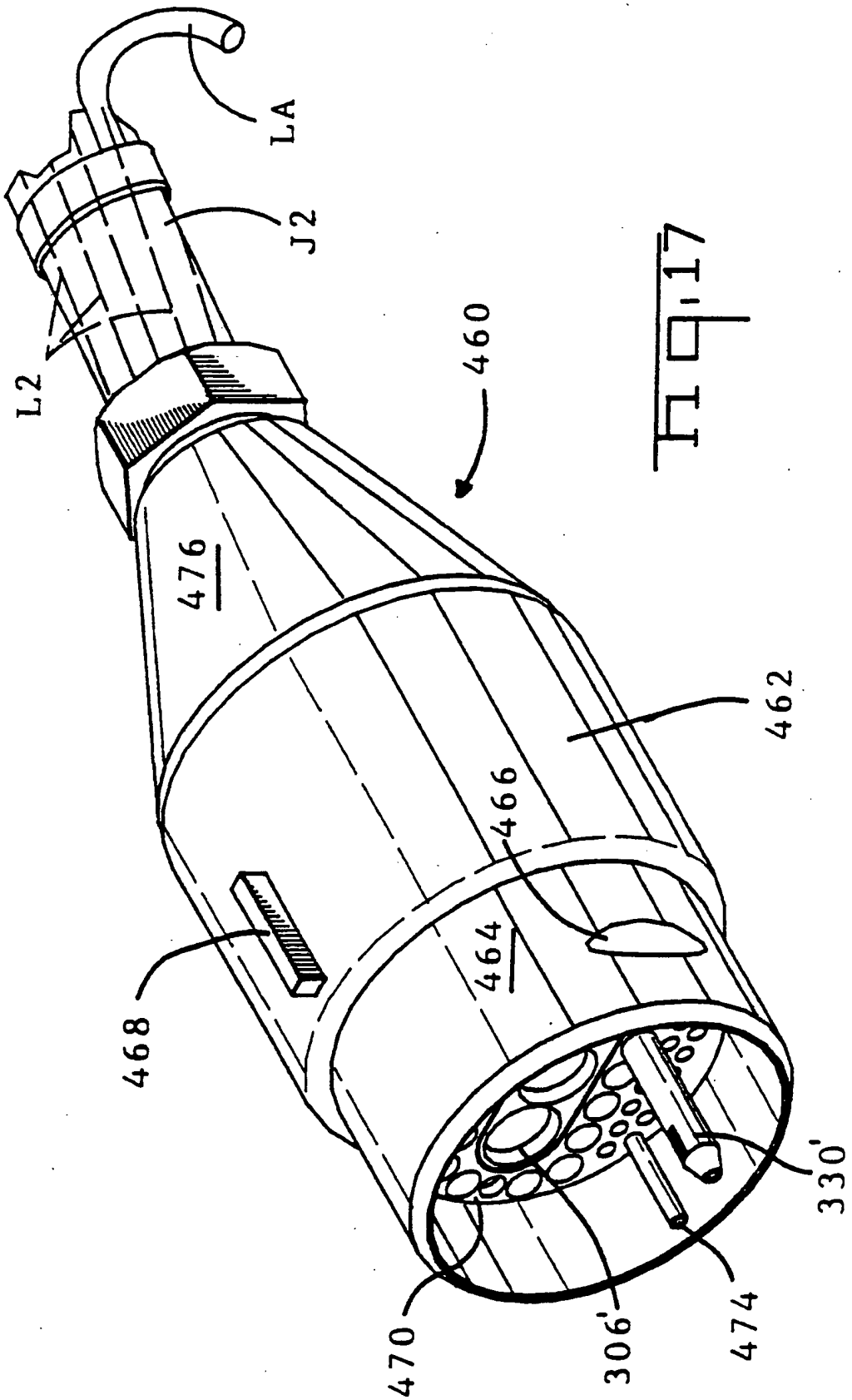

Fig.17

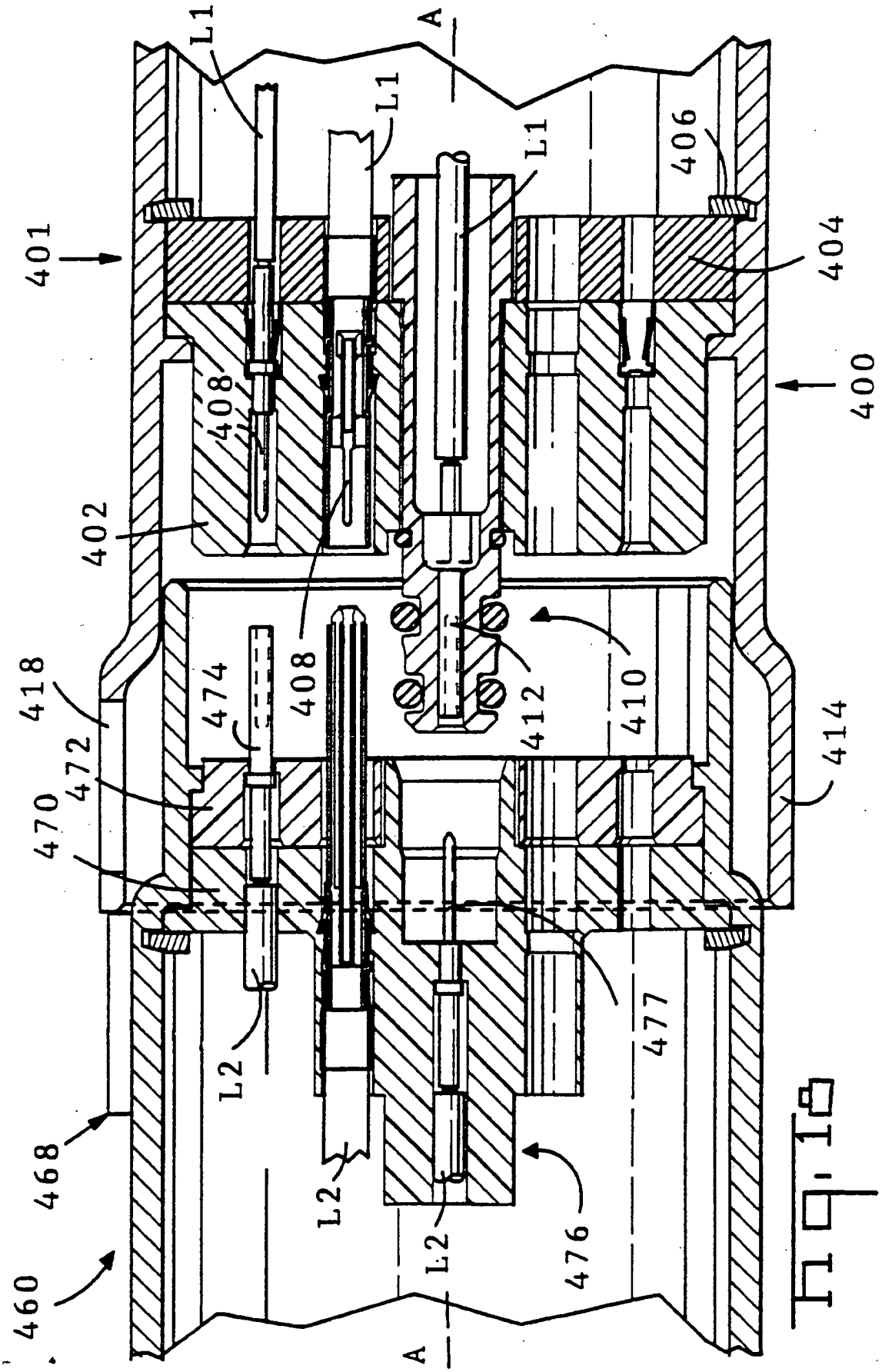
L1
A
L1
L1
406
401
404
400
408
402
418
474
408
412
410
414
472
470
L2
477
468
L2
L2
476
460
A

Fig. 1a